

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization International Bureau



(43) International Publication Date  
4 November 2004 (04.11.2004)

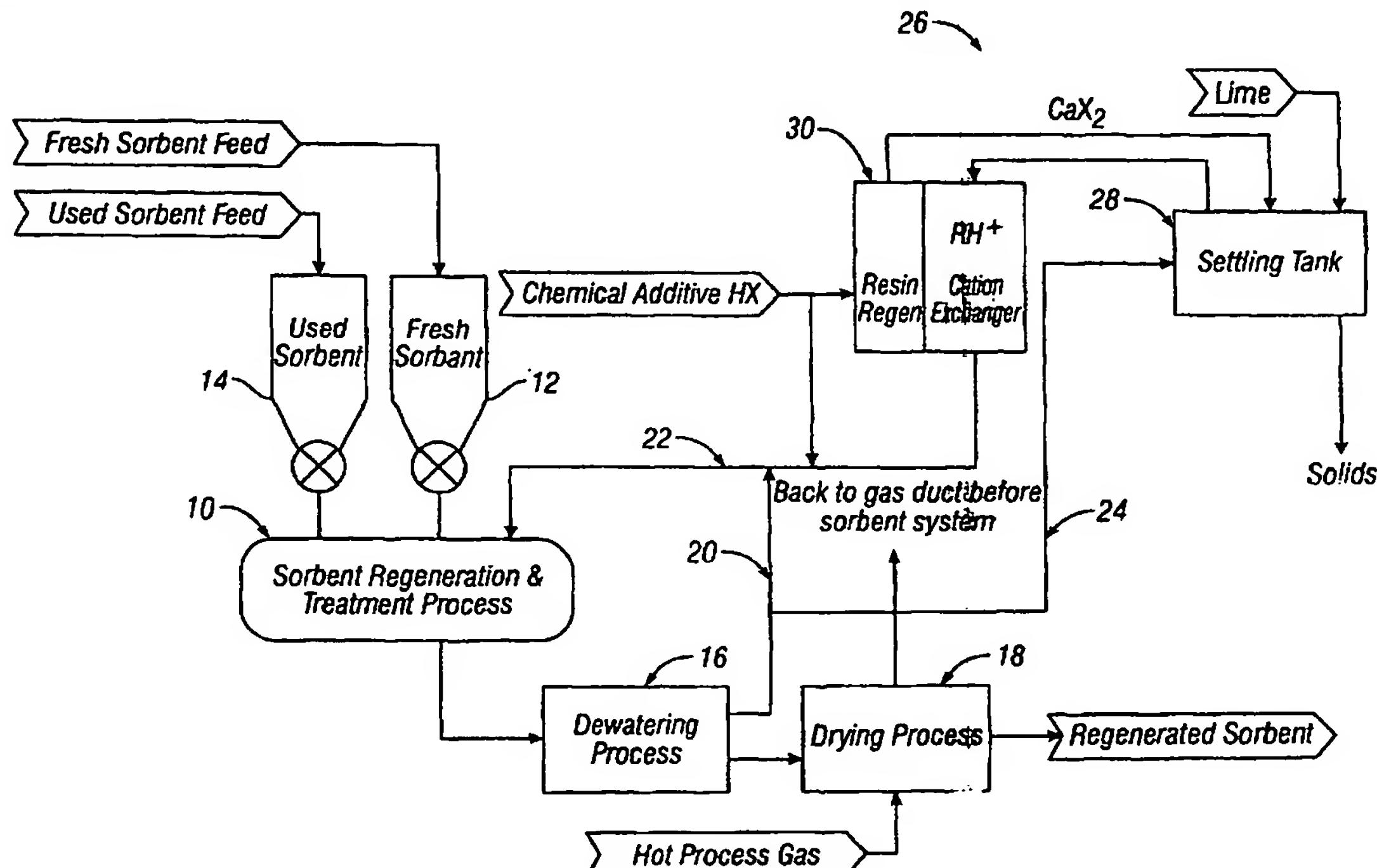
PCT

(10) International Publication Number  
**WO 2004/094024 A3**

- (51) International Patent Classification<sup>7</sup>: **B01J 20/34, 38/48, 38/60, 38/62**
- (21) International Application Number: **PCT/US2004/012828**
- (22) International Filing Date: **23 April 2004 (23.04.2004)**
- (25) Filing Language: **English**
- (26) Publication Language: **English**
- (30) Priority Data: **60/464,868 23 April 2003 (23.04.2003) US**
- (71) Applicant (*for all designated States except US*): **ENERGY & ENVIRONMENTAL RESEARCH CENTER FOUNDATION, INC. [US/US]; 15 North 3rd St., PO Box 9018, Grand Forks, North Dakota 58202-9018 (US).**
- (72) Inventors; and
- (75) Inventors/Applicants (*for US only*): **OLSON, Edwin [US/US]; 223 Circle Hills Drive, Grand Forks, North Dakota 58202-9018 (US).**
- Dakota 58201 (US). **HOLMES, Michael [US/US]; 614 6th Ave NE, Thompson, North Dakota 58278 (US).**  
**PAVLISH, John [US/US]; 42204 210th St SW, East Grand Forks, Minnesota 56721 (US).**
- (74) Agent: **JOHNSON, Bruce, A.; Johnson & Associates, PO Box 90698, Austin, Texas 78709-0698 (US).**
- (81) Designated States (*unless otherwise indicated, for every kind of national protection available*): **AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.**
- (84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): **ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR,**

[Continued on next page]

(54) Title: PROCESS FOR REGENERATING A SPENT SORBENT



WO 2004/094024 A3

(57) Abstract: A method and apparatus is provided for regenerating a sorbent (12,14) that has been poisoned by components derived from flue gas. The sorbent is treated with an agent (10) to remove poisoning components and introduce a promoting agent into the sorbent (22). The method and apparatus can also be used to enhance the effectiveness of a new sorbent (18).



GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(88) Date of publication of the international search report:  
16 December 2004

**Published:**

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/12828

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B01J 20/34, 38/48, 38/60, 38/62  
 US CL : 502/22, 27, 28

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
 U.S. : 502/22, 27, 28

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
 NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
 Please See Continuation Sheet

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category *       | Citation of document, with indication, where appropriate, of the relevant passages                         | Relevant to claim No.   |
|------------------|--|---|
| X, P<br>—<br>Y,P | US 6,579,507 B2 (PAHLMAN et al) 17 June 2003 (17.06.2003), column 10, lines 39-67; column 40, lines 32-67. | 1-3,11-14,17-22,26-32,36-38,42-48,55-58, and 62-69<br>——<br>4-10,15,16,23-25,33-35,39-41,49-51, and 59-61 |
| X                | US 6,475,451 B1 (LEPPIN et al) 05 November 2002 (05.11.2002), see abstract.                                | 43-48   |
| A                | US 5,827,352 (ALTMAN et al) 27 October 1998 (27.10.1998), see abstract and entire patent.                  | 1-69  |
| Y                | US 5,480,619 (JOHNSON et al) 02 January 1996 (02.01.1996), see abstract, col . 4, lines 30-35.             | 7-10, 15,16,23-25,33-35,39-41,49-51 and 59-61   |
| Y                | US 4,196,173 (deJong et al.) 01 April 1980 (01.04.1980), see abstract.                                     | 4-6   |

Further documents are listed in the continuation of Box C.

See patent family annex.

|   |     |  |
|---|-----|--|
| * Special categories of cited documents:  | "T" | later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  |
| "A" document defining the general state of the art which is not considered to be of particular relevance  | "X" | document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone   |
| "E" earlier application or patent published on or after the international filing date   | "Y" | document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |
| "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | "&" | document member of the same patent family  |
| "O" document referring to an oral disclosure, use, exhibition or other means  |     |  |
| "P" document published prior to the international filing date but later than the priority date claimed  |     |  |

Date of the actual completion of the international search

22 September 2004 (22.09.2004)

Date of mailing of the international search report

22 OCT 2004

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US  
 Commissioner of Patents  
 P.O. Box 1450  
 Alexandria, Virginia 22313-1450

Faxsimile No. (703) 305-3230

Authorized officer

Jonas N. Strickland

Telephone No. 571-272-1700

**INTERNATIONAL SEARCH REPORT**

PCT/US04/12828

**Continuation of B. FIELDS SEARCHED Item 3:**

EAST, WEST search terms: sorbent, regeneration, mercury, acid, water, solvent, solution, liquid, reactivation